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REMARKS

Claims 1-24 are pending in the present application. The Specification has been amended to correct certain typographical errors. The Specification has also been amended to reflect the issuance of the relevant cited patent applications to patents. No new matter has been introduced by those amendments. Reconsideration and allowance of Claims 1-24 is requested in light of the following remarks.

Claim Rejections Under 35 U.S.C. § 102(b)

Claims 1, 2, 11-13, 15, and 21 stand rejected under 35 U.S.C. § 102(b), as allegedly anticipated by U.S. Patent No. 6,048,645 to Saidi et al. ("Saidi"). In particular, the Examiner asserts in part that Saidi discloses an electrochemical cell comprising a positive electrode comprising a current collector and an active material selected from the group consisting of manganese dioxide. Applicants respectfully traverse this rejection.

To anticipate a claim, a reference must disclose each and every element of the claim. *Lewmar Marine v. Varient Inc.*, 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987). Claims 1, 2, 11-13, and 15 require in part: "a positive electrode comprising a current collector and an active material selected from the group consisting of manganese dioxide, silver oxide, iron sulfide and mixtures thereof." Additionally, independent Claim 21 requires in part: "a positive electrode comprising a current collector and manganese dioxide." Applicants respectfully submit that Saidi does not teach or suggest a positive electrode comprising manganese dioxide, and therefore, that Saidi does not anticipate Claims 1 and 21.

Saidi teaches a lithium-ion battery which comprises in part a positive electrode having an active material comprising the lithium-rich manganese oxide tetragonal structure Li₂Mn₂O₄ (column 2, lines 45-48). The lithium manganese oxide of Saidi is chemically distinct from the manganese dioxide claimed by Applicants; it is therefore improper to equate these two compounds for 35 U.S.C. § 102(b) purposes.

Applicants do acknowledge that Saidi discloses manganese dioxide. However such a disclosure is limited to the use of manganese dioxide as a precursor to the formation of an orthorhombic form of LiMnO₂ (column 3, lines 29-31). Saidi teaches that a form of

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manganese dioxide, i.e., electrochemical manganese dioxide (EMD), may be formed by an electrolysis process by which a gamma EMD is deposited directly on an anode electrode (column 7, lines 45-48). The EMD deposit is *removed* from the anode, crushed, ground, washed, neutralized and dried in a rotary dryer (column 7, lines 50-52). The EMD is then used to form the preferred beta manganese dioxide *precursor* used to react with the lithium compound by heating the EMD to a temperature of about 400°C (column 7, lines 31-37). The electrode taught in Saidi is then made by mixing a binder, the active material, i.e., $\text{Li}_2\text{Mn}_2\text{O}_4$, and a carbon powder (column 8, lines 63-64). A paste containing the binder, active material, and carbon is coated onto a current collector (column 8, lines 65-67). The positive electrode, therefore, comprises the lithium manganese oxide active material (column 8, line 67 – column 9, line 1), and not manganese dioxide.

In summary, the active material taught in Saidi is not actually formed on the positive electrode. Rather, the active material is first formed separately from the positive electrode, and then applied onto the electrode as a fully formed lithium manganese oxide. Applicants, therefore, respectfully submit that nowhere in Saidi is it taught or suggested that the positive electrode comprises manganese oxide as is required by claims 1 and 21. Therefore, because Saidi does not teach an element of Claims 1 and 21, it cannot anticipate these claims.

Applicants further note that in the rejection of the claims under 35 U.S.C. § 102(b), the Examiner has asserted that Saidi “clearly discloses the Manganese [sic] dioxide deposited on the anode.” (Paper 12, Page 2, paragraph 1). Although Saidi does disclose depositing manganese dioxide onto the anode as part of the synthesis of the LiMn_2O_4 active material (column 7, line 49-50), Applicants respectfully submit that Saidi does not teach a *positive electrode* comprising manganese dioxide as required by the claims. Rather, Saidi teaches that the formation of EMD involves an electrolysis process by which gamma EMD is deposited directly on an *anode* electrode (column 7, lines 45-48). As defined by Saidi, the anode is the negative electrode of the cell (column 1, line 20). As Saidi teaches the disposition of EMD on the anode, rather than on the positive electrode, Saidi does not teach or suggest all elements of Claims 1 and 21. Therefore, Saidi does not anticipate these claims.

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Accordingly Applicants respectfully submit that not all elements of Claims 1, 2, 11-13, 15, and 21 are taught by Saidi, and that, therefore, Saidi does not anticipate these claims. Therefore, Applicants respectfully request the reconsideration of Claims 1, 2, 11-13, 15, and 21, and withdrawal of the rejections.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 3, 4, 8, 10, 14, 16-20, and 22-24 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Saidi in view of U.S. Patent No. 5,953,204 to Suhara et al. ("Suhara"). Claims 5-7 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Saidi in view of Suhara as applied to claim 4, and further in view of U.S. Patent No. 6,031,711 to Tennent et al. ("Tennent"). In particular, the Examiner has indicated that Saidi discloses all limitations of the rejected claims except for the limitation of the current collector being selected from the group consisting of metal foil, metal mesh, electrically conductive polymer composites and expanded metal. Suhara has been cited for teaching that current collectors can be made of metal foil. Tennent has been cited for disclosing carbon fibers less than 10-100 nanometers in diameter. Applicants respectfully traverse these rejections.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing a *prima facie* case of obviousness. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). Establishing a *prima facie* case of obviousness requires that all elements of the invention be disclosed in the prior art. *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). As discussed above, Saidi does not teach or suggest manganese dioxide as an active material. Neither Suhara nor Tennent remedies this deficiency. In fact, the positive electrode of Suhara employs a polarizable material composed mainly of activated carbon and there is no mention of manganese dioxide. Because neither Saidi, Suhara nor Tennent, either alone or in combination, disclose manganese dioxide as an active material for the positive electrode, not all elements of the claims are found in the cited art and a *prima facie* case of obviousness has not been established. Applicants respectfully request withdrawal of the rejection of Claims 3-8, 10, 14, 16-20, and 22-24 under 35 U.S.C. § 103(a).

Claim 9 stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Saidi in view of U.S. Patent No. 5,415,959 to Pyszczek et al. ("Pyszczek"). In particular, the

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Examiner states that Pyszczek teaches that the carbonaceous active material is non-woven mat. Applicants respectfully traverse this rejection.

Pyszczek discloses a fabric separator for use in an electrochemical cell comprising an anode (negative electrode) made of metals from Groups IA, IIA, and IIIB of the Periodic Table such as lithium and a cathode (positive electrode) that may be made of manganese dioxide, iron sulfide or other metal compounds. The anodic material typically comprises a thin sheet of foil (column 4, lines 10-33)

As discussed above, Saidi discloses $\text{Li}_2\text{Mn}_2\text{O}_4$ as the active material for the positive electrode. The negative electrode may be metallic lithium but is preferably an intercalation active material such as metal oxide or graphite (column 9, lines 27-41). Saidi does not disclose the use of manganese dioxide, silver oxide, iron sulfide and mixtures thereof as active material in the positive electrode as claimed in the pending application. Although Pyszczek has been cited for its teaching regarding a separator comprising a non-woven mat, Pyszczek appears also to provide the element of manganese dioxide as an active material for the positive electrode.

An Examiner cannot establish obviousness by locating references that describe various aspects of a patent applicant's invention without also providing evidence of the motivating force which would have impelled one skilled in the art to do what the patent applicant has done. *Ex parte Levengood*, 28 U.S.P.Q. 1300 (Bd. Pat. App. Int. 1993). The references, when viewed by themselves and not in retrospect, must suggest the invention. *In Re Skoll*, 187 U.S.P.Q. 481 (C.C.P.A. 1975).

Saidi discloses only one useful active material for the positive electrode, $\text{Li}_2\text{Mn}_2\text{O}_4$. Saidi does not teach or suggest that any other material would be useful as the positive electrode active material. Similarly, Pyszczek does not teach or suggest that manganese dioxide or iron sulfide can be used in place of $\text{Li}_2\text{Mn}_2\text{O}_4$ or in combination with a negative electrode comprising carbonaceous active material. Therefore Applicants respectfully assert that there is no motivation to combine the positive electrode active material of Pyszczek with Saidi; therefore, the claimed invention is not obvious.

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In light of the foregoing amendments and remarks, reconsideration by the Examiner is respectfully requested. It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' attorneys.

Respectfully submitted,

LIPKA ET AL.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

A marked-up version of the 1st paragraph on page 5 follows:

The asymmetric supercapacitor has improved energy density by electrically coupling a positive electrode of high faradaic capacity such as one comprising manganese dioxide (MnO_2) with a negative electrode that stores charge through charge separation at the electric double-layer such as one comprising carbon. The asymmetric supercapacitor also improves power density by using high surface area nanostructured electrode materials.

A marked-up version of the last paragraph on page 5 follows:

An asymmetric supercapacitor comprises a positive electrode comprising a current collector and an active material selected from the group consisting of manganese dioxide, silver oxide, iron sulfide and mixtures thereof, a negative electrode comprising a carbonaceous active material and optional current collector, an electrolyte, and a separator plate. In a preferred embodiment at least one of the electrodes comprises nanostructured/nanofibrous material and in a more preferred embodiment, both electrodes comprise nanostuctured/nanostructured/nanofibrous material. The electrolyte can be liquid or solid although liquid electrolytes are preferred. The asymmetric supercapacitor can be used either in bipolar or monopolar construction.

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A marked-up version of the 1st paragraph on page 7 follows:

Suitable active materials for the positive electrode include manganese dioxide, silver oxide, iron sulfide or mixtures thereof. Manganese dioxide is preferred. The active material is typically in particulate form, the particles of which have a mean single linear dimension of less than about 100 microns and is preferably nanostructured. The particular form of the active material will depend on the desired performance, cost and other characteristics of the asymmetric supercapacitor. It is contemplated that a wide variety of forms may be used, for example shapes both irregular and regular, such as amorphous, fibrous, spheroidal, rhomboidal and the like, bird's nest and the other forms described in U.S. Application Serial No. 08/971,817, now U.S. Patent No. 6,162,530, as well as nanorods disclosed in U.S. Patent No. 6,036,774 which is incorporated by reference herein. Synthesis and structure of suitable nanostructured sulfides, oxides and hydroxides is disclosed in U.S. Serial No. 08/971,817, now U.S. Patent No. 6,162,530, and U.S. Serial No. 09/579,874, now U.S. Patent No. 5,713,561, incorporated herein by reference. Nanostructured materials are well suited for use in electrodes because they have extremely high surface activity and high accessible surface area. This is in contrast to other high surface area materials in which much of the surface area is contained in deep micropores and thus is largely non-utilizable in capacitor applications. As used herein a nanostructured material refers to materials having a grain size on the order of 1 to 100 nanometers (where 1 nm = 10 angstroms). Nanostructured materials are thus characterized by having a high fraction of the material's atoms residing at grain or particle boundaries. For example, with a grain size in the five nanometer range, about one-half of the atoms in a nanocrystalline or a nanophase solid reside at grain or particle interfaces.

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A marked-up version of the 3rd full paragraph on page 8 follows:

Preferably the electrodes may be formed by thermal spraying onto the current collector. Thermal spray techniques are disclosed in U.S. Application No. 09/485,424, now U.S. Patent No. 5,599,644, which is herein incorporated by reference. A suspension of nanocrystalline particles is subjected to ultrasonication using an intense ultrasonic probe. Ultrasonication disintegrates any powder aggregates and introduces lattice defects into the nanocrystalline particles. These defects can exert an important influence on the performance of nickel hydroxide, for example, when it is used as the active material in a nickel electrode. Parameters, which affect the final product, include ultrasonic power and processing time.